JHR 80: 137–145 (2020)
doi: 10.3897/jhr.80.58882
https://jhr.pensoft.net

SHORT COMMUNICATION

JOURNAL OF Hymenoptera RESEARCH
A peer-reviewed open-access journal
The International Society of Hymenopterists

First record of *Leptoomus janzeni* Gibson (Hymenoptera, Chalcidoidea) from Rovno amber

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Academic editor: P. Jansta | Received 22 September 2020 | Accepted 18 November 2020 | Published 29 December 2020

http://zoobank.org/AC95CBDE-AA85-4A7D-9B42-4B1CA032AEDB

Citation: Simutnik SA, Perkovsky EE, Vasilenko DV (2020) First record of *Leptoomus janzeni* Gibson (Hymenoptera, Chalcidoidea) from Rovno amber. Journal of Hymenoptera Research 80: 137–145. https://doi.org/10.3897/jhr.80.58882

Abstract

The large and distinctive chalcidoid wasp *Leptoomus janzeni* Gibson, 2008, originally described from late Eocene Baltic amber, is newly recorded from coeval Rovno amber (Ukraine) based on a single well-preserved female specimen. Only 66 species of Rovno hymenopterans (49%) are also known from Baltic amber. High resolution photomicrographs and measurements of the specimen are given. Some character states of the new specimen, such as a green metallic coloration, a bare and flat prepectus, location and number of multiporous plate sensillae on the flagellum, sclerotized spur vein of the hind wing, and two metatibial spur are reported in this species for the first time.

Keywords

Baltic amber, Eocene, prepectus, spur vein, Ukraine

Introduction

Chalcidoidea (Hymenoptera) are currently divided into 23 extant families (Heraty et al. 2013; Janšta et al. 2018). Members of the families Cynipencyrtidae, Encyrtidae, Eupelmidae (except male Eupelminae), and Tanaostigmatidae share an enlarged, convex mesopleuron (acropleuron *sensu* Gibson 1986) and several other correlated

adaptations hypothesized to enhance jumping ability (Gibson 1986). It has sometimes been suggested that these taxa constitute a monophyletic group based on this enlarged mesopleuron (Trjapitzin 1968, 1989; LaSalle 1987). However, Gibson (1989) did not find any putative synapomorphies for the group as he defined it, and the morphological analysis of Heraty et al. (2013) retrieved the group as a monophyletic only if *Oodera* Westwood (Pteromalidae: Cleonyminae) was included. The combined morphological-molecular results of Heraty et al. (2013) did not retrieve this group as monophyletic, nor did the transcriptome-based phylogenies of Peters et al. (2018) and Zhang et al. (2020), suggesting that adaptations for jumping evolved independently.

Here, we report a large and well-preserved female from Rovno amber that we treat as conspecific with *Leptoomus janzeni* Gibson, 2008 (Chalcidoidea), originally described from Baltic amber. Gibson (2008) did a detailed analysis of the morphology of *L. janzeni* and compared it with that of *Cynipencyrtus* Ishii, 1928 (Cynipencyrtidae), Encyrtidae, Eupelmidae, and Tanaostigmatidae. This suggested that *Leptoomus* is likely in or near *Clade E*, sensu Heraty et al. (2013), the chalcid "jumpers" with an enlarged acropleuron. Gibson (2008, p. 24) proposed: "*until evolutionary relationships of the treated taxa are established more confidently by such studies it seems prudent to classify L. janzeni along with Cynipencyrtus in Tanaostigmatidae*". Members of Tanaostigmatidae are distinguished in particular by an enlarged, bulbous prepectus projecting anteriorly beside the pronotum that resembles the prepectal structure of *L. janzeni* (Figs 1B, C, 2A: pre).

Material and methods

Ukrainian Rovno amber (Priabonian stage, 33.9–37.8 Mya) is the southern coeval of Baltic amber, from which *L. janzeni* was described. The amber containing the specimen of *L. janzeni* was found at the village of Velyki Telkovichi (Vladimirets Distr., Rovno Region, Ukraine) and is housed at the Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine, Kiev (SIZK). The localities and composition of the Rovno amber fauna were recently characterized in a series of reviews by Perkovsky et al. (2010), Jałoszyński and Perkovsky (2016), Perkovsky (2016, 2018) and Martynova et al. (2019). Including *Ektopicercus punctatus* Simutnik (Simutnik and Perkovsky 2020), and *L. janzeni*, 135 species of Hymenoptera are now known from Rovno amber, with 66 (49%) in common with Baltic amber (Radchenko and Perkovsky 2020; this paper).

Nearly all studied Rovno amber inclusions from Rovno Region were collected from Klesov and the Horyn River Basin (Perkovsky et al. 2010; Perkovsky 2017) except new collections from the more western basins of the Styr and Stokhod rivers and especially the Veselukha River floodplain between them (Lyubarsky and Perkovsky 2020). These new collections (mostly from Voronki and Velyki Telkovichi) revealed a number of new species of beetles, neuropterans and snakeflies (Jałoszyński and Perkovsky 2019; Legalov et al. 2019; Colombo et al. 2020; Perkovsky and Makarkin 2019,

2020; Makarkin and Perkovsky 2020; Lyubarsky and Perkovsky 2020; Radchenko and Khomich 2020; Perkovsky et al. 2020) as well as new mosses and liverworts (Mamontov et al. 2020 and references therein), including the first named amber *Sphagnum* from Velyki Telkovichi and some species previously recorded from Baltic amber (Perkovsky and Olmi 2018; Martynova et al. 2019; Mamontov et al. 2020) or from Baltic and Bitterfeld ambers (Radchenko and Perkovsky 2018, 2020).

Photographs were taken using a Leica Z16 APO stereomicroscope with a Leica DFC 450 camera and processed with LAS V3.8 software. To improve imaging, we applied sucrose syrup of approximately the same refractive index as the amber and placed a glass coverslip on top; after photography, the syrup was removed using warm water. Some images were then enhanced (brightness and contrast only) using Adobe Photoshop.

Terminology and abbreviations follow Gibson (1997), Noyes et al. (1997), and Heraty et al. (2013). The following abbreviations are used in the text and illustrations:

OOL	minimum distance between an eye margin and the adjacent posterior ocellus;
POL	minimum distance between the posterior ocelli;
OCL	minimum distance between a posterior ocellus and the occipital margin;
LOL	minimum distance between the anterior ocellus and a posterior ocellus;
F1, F2, etc.	funicular segments 1, 2, etc.;
mps	multiporous plate sensilla;
mspl	mesopleuron;
pre	prepectus;
spv	spur vein.

Results

Taxonomy

Chalcidoidea Latreille, 1817

***Leptoomus janzeni* Gibson, 2008**
Figs 1, 2A–E

Material examined. SIZK VT-95, 1 ♀, Velyki Telkovichi, Rovno amber; late Eocene. The inclusion is in a clear amber piece (about of 30 × 14 × 8 mm) of irregular shape (Fig. 1A). A syninclusion consists of a precariously preserved small insect with only the legs visible.

Measurements. Body length 2.45 mm; other reported measurements are relative (one micrometer division = 0.014 mm) and are approximate because of optical effects in the amber.

Head. Head length 26, width 46, height 38; eye height 15; malar space 15; posterior ocellus diameter 3; OOL 1.5; POL 7; OCL 6; LOL 5; distance between toruli 7,

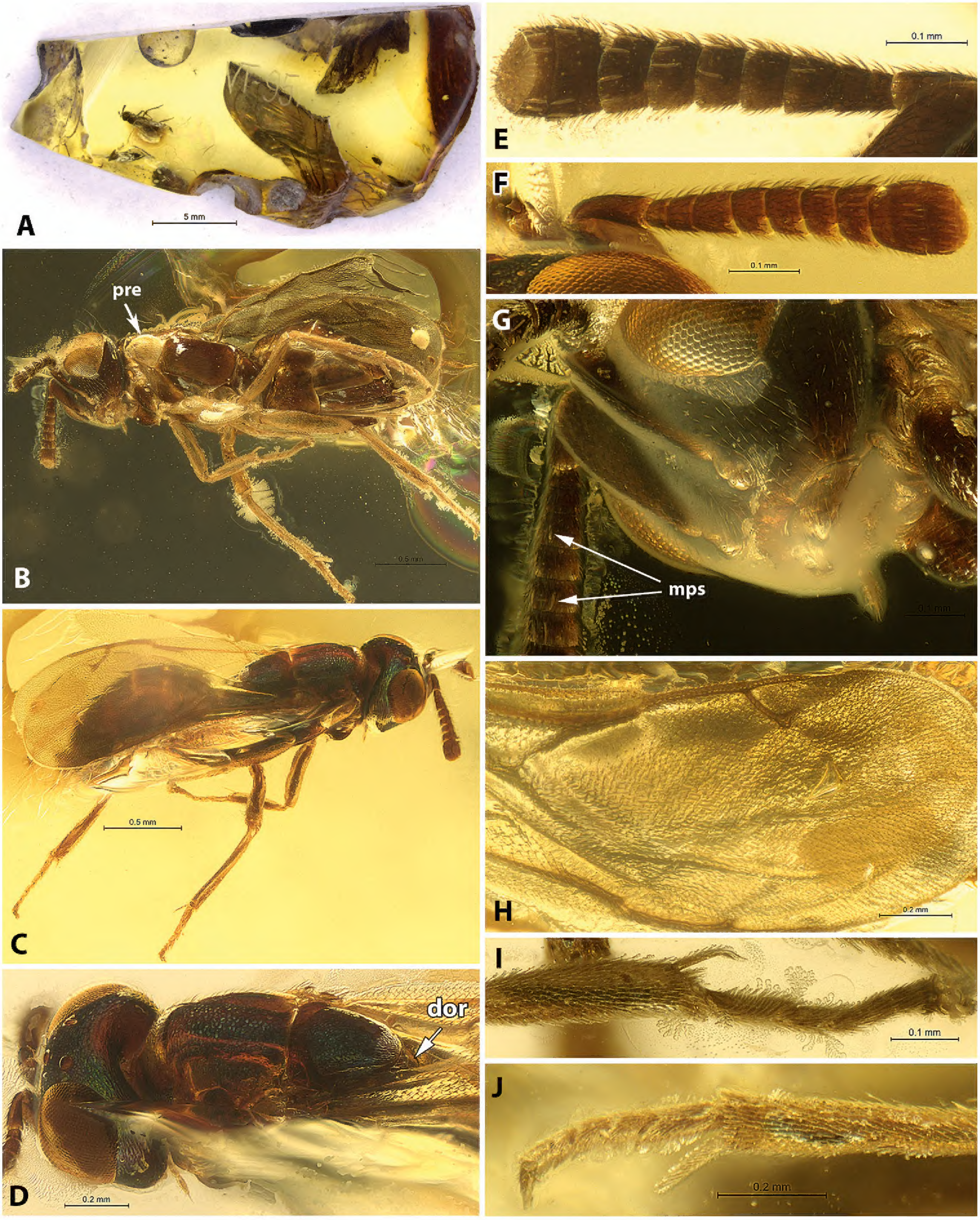

Figure 1. *Leptoomus janzeni*, female VT-95 from Rovno amber (deposed in SIZK) **A** piece of amber containing the specimen **B** habitus ventrolateral (left side) **C** habitus dorsolateral (right side) **D** head and mesosoma dorsolateral, dorsellum **E** antenna ventral **F** antenna dorsal **G** head frontolateroventral, part of antenna with mps arrowed **H** forewing **I** protibial spur, protarsus **J** mesotibial spur, mesotarsus.

between torulus and eye 9, from torulus to mouth margin 6; length to width ratio of scape 25:7, pedicel 8:4, F1 2:4, F2 3:4.5, F3 4:5, F4 3:5, F5 3:5.5, F6 3:6, F7 3:7 (very approximately), clava 7.5:10, micropilose sensory region 5:7.5.

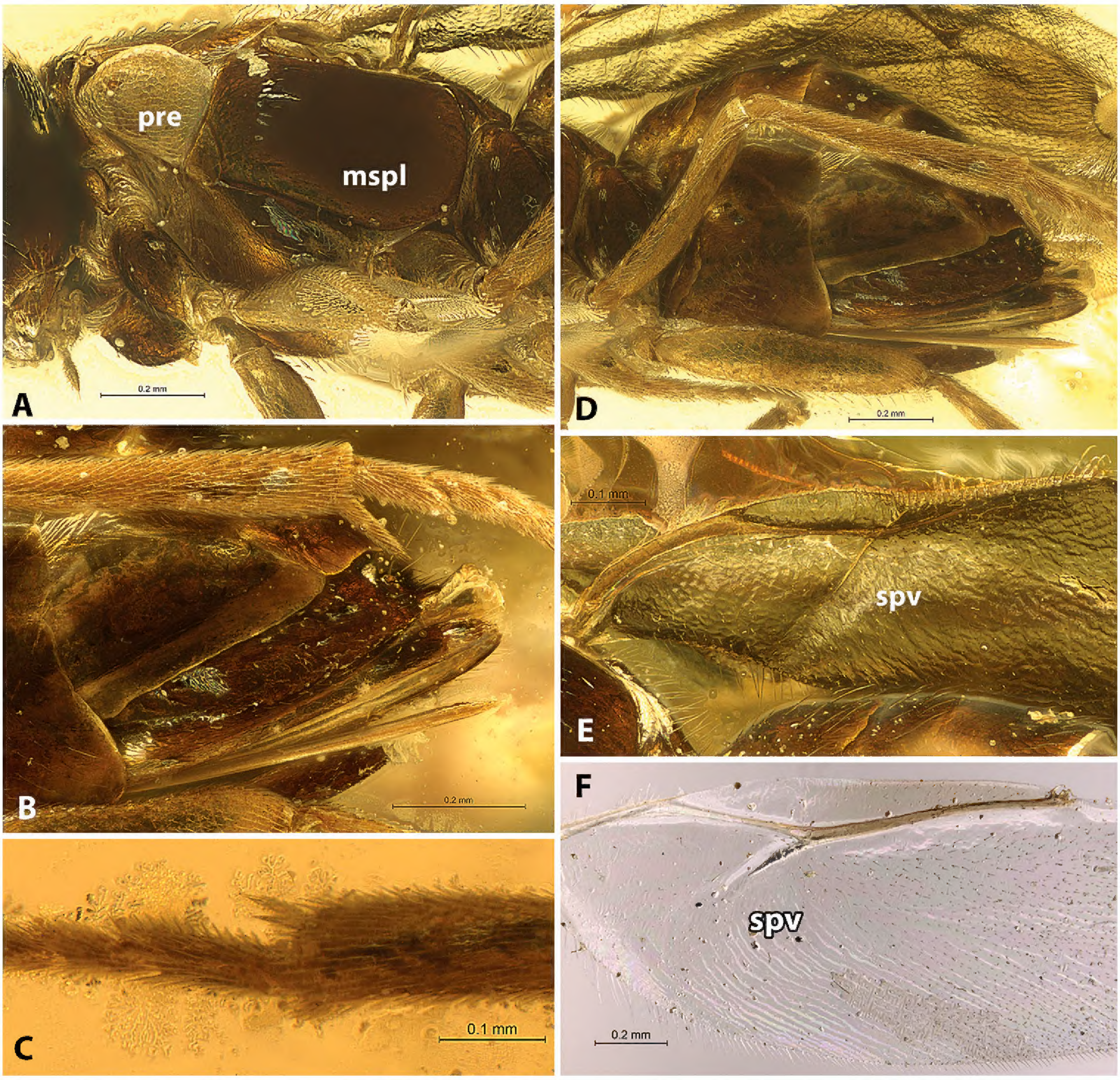

Figure 2. A–E *L. janzeni*, female **A** mesosoma ventrolateral **B** apex of metasoma lateroventral **C** metatibial apex with two spurs **D** metasoma lateral **E** venation of hind wing with spur vein **F** *Pentacladia* sp., female, venation of hind wing.

Mesosoma. Mesosoma length 68; length to width ratio of mesoscutum 30:30, scutellum 26:21; prepectus maximal length 16, height 15.

Appendages. Length to width ratio of fore wing 120:55; mv:pmv:stv about 22:18:15; length to width ratio of hind wing 77:25; protibia 30, protibial spur (calcar) 8; mesotibia 48, mesobasitarsus 12, mesotibial spur 11.

Metasoma. Length 77, height 45 (lateral view), width 45; ovipositor stylet from hypopygium margin 41.

Comparison with *L. janzeni* type material. The Rovno amber specimen differs from the Baltic amber material by having slightly infuscate, brownish, rather than hyaline forewings. The head and thorax have a distinct green metallic sheen not seen in the Baltic specimen (Figs 1C, D). Multiporous plate sensilla on the flagellum were not described by Gibson (2008), but are visible in the Rovno specimen on F3–F7, and on

the apical two segments of the 3-segmented clava (Figs. 1E, F, G); F4 appear to have only a single mps but the others have multiple mps in a single row per segment that does not fully encircle the segment.

Also, in the Rovno specimen the spur vein originating from the marginal venation of the hind wing is visible (Fig. 2E: spv). In addition to Tanaostigmatidae, some Pteromalidae (for example, *Nasonia*), and some Eupelmidae (e.g. *Pentacladia*, Fig. 2F: spv) also have a similar sclerotized spur vein.

The only uniquely shared feature of *L. janzeni* and Tanaostigmatidae is that in both the prepectus extends anteriorly, exterior to pronotum, though in *L. janzeni* it is flatter and its lateral panel is bare (Figs 1B, 2A: pre).

The metatibia of the new specimen has two spurs (Fig. 2C). This character *L. janzeni* shares the with many other chalcidoid taxa.

The metanotum is not clearly visible because the wings are positioned over the gaster. The dorsellum (Fig. 1D: dor) appears to taper posteriorly to fit into a broadly incised anterior margin of the propodeum such that the medial length of the dorsellum is greater than the medial length of the propodeum.

Conclusions

The set of morphological features possessed by *L. janzeni* places the taxon in the "jumpers" Clade E sensu Heraty et al. (2013). As previously shown by Gibson (2008), *L. janzeni* appears to be close to Tanaostigmatidae. To establish the position of *L. janzeni* on the chalcidoid tree, further research is needed with additional fossil and molecular data.

Acknowledgements

We are grateful to Gary A.P. Gibson (Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture and Agri-Food Canada) for confirming the correctness of the determination of the *L. janzeni* and valuable comments; Anatoly P. Vlaskin (SIZK) for cutting and polishing the sample, Bruce Archibald (Simon Fraser University, Burnaby, Canada) for editing of the English. The authors are thankful to the editor Petr Janšta and to an anonymous reviewer for corrections. The study was supported by the National Research Foundation of Ukraine grant "Leading and Young Scientists Research Support" (registration number 2020.02 / 0369) for the first author.

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